MINISTRY OF TRANSPORTATION

Road Talk

Ontario's Transportation Technology Transfer Digest • Fall 2006 • Vol 12 Issue 3

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MTO selected for Upcoming Award pg. 6

Value Engineering

The "Value" of Partnerships

Facing north: (south to north) Arnprior Aerospace, Highway 17, Town of Arnprior, Ottawa River.

Since the mid-1990s, the Ministry of Transportation (MTO) has been using Value Engineering (VE) to ensure that the Ontario taxpayer receives best "value" on capital projects, as well as for process and standards development. Good value is achieved when the required performance can be accurately defined and delivered at the lowest life cycle cost. The systematic approach of a VE study allows team members to communicate effectively across specialist boundaries thereby ensuring that all team members can understand different perspectives, while fostering innovation and creativity.

The Planning and Design Section of Eastern Region (ER) arranged for a VE study to be performed for a section of Highway 17 twinning near the Town of Arnprior. Highway 17 is the major east-west highway linking Ottawa with communities along the Ottawa River. As traffic volumes on this route were growing, MTO embarked on converting the existing two-lane highway into a fully controlled access freeway to improve the efficiency and safety of the route. The project planning for this work had been completed several years earlier and the detail design had just commenced. Although MTO had an approved plan under the Environmental Assessment Act, the region recognized that several years had elapsed since its completion and that several changes had occurred in the Arnprior area that could affect the design. Since the design schedule was quite aggressive, ER recognized that it was imperative to involve key local stakeholders on the VE team so that their concerns and input could be directly communicated and appreciated by the VE team.

Traditionally, stakeholders have been invited to participate at the outset of a VE workshop, and then attend later in the process to >

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Technology Transfer is a communication process by which information, regarding an improvement in a product or method, is exchanged and implementation into practice is facilitated.

Ontario

> hear the study results. If the stakeholders do not agree with the proposed alternatives flowing from the VE study, it may be necessary to revisit the study's recommendations to reach agreement. While this is appropriate for studies with generous schedules, it does not work well for projects with more pressing deadlines.

The construction of the Highway 17 twinning project required several access roads to be realigned/constructed, which would impact directly on Arnprior Aerospace's lands (known as Boeing Canada at the time of the VE study) located on the south side of the new highway. In addition, the construction would create changes in travel patterns both temporarily during the construction and permanently after construction. Furthermore, the new travel patterns would have a significant impact on Arnprior Aerospace's employees accessing the plant to go to work, as well as impacting the mobility of the local residents. To better address these issues, MTO invited Arnprior Aerospace and the Town of Arnprior to join the VE team as full-time participants. Both parties readily agreed to take part in the VE study.

Over the course of the study, the team identified key issues for both the Town of Arnprior and Arnprior Aerospace, and as a result generated ideas to address these issues by revising the proposed service road layout and construction staging. Since both the Town of Arnprior and Arnprior Aerospace were involved in the generation, development and evaluation of the solutions, all parties supported the post-workshop presentation to the stakeholders. By involving the stakeholders as full partners in the process from the beginning, the VE team prevented the design schedule from being adversely impacted because the stakeholders concerns were addressed from the outset, instead having to taken into consideration later and delaying the progression of the project.

The VE study was lead by Totten Sims Hubicki Associates (TSH) on behalf of the design consultant McCormick Rankin Corporation (MRC). Over a three and a half day period, the VE team was able to identify a total of $2.4M of cost savings out of a total project value of about $50M, while maintaining the performance of the project. Some of the key changes to the project plan included avoiding Arnprior Aerospace's property to accommodate the company's future growth plans; and combining two proposed detours into a single detour, thereby minimizing the number of conflict points (including Arnprior Aerospace's property) on the existing highway while improving safety. Furthermore, the overpass at Baskin Drive was lengthened to maintain flexibility for pedestrian and cyclist crossings. In addition, the construction of several low volume ramps at the County Road 29 interchange was deferred, thus providing a significant reduction in initial construction costs without reducing the function of the project.

This study reaffirmed that the VE process allows MTO to provide the highest quality projects that consistently provide the best value for the taxpayer. The inclusion of key stakeholders on the VE team ensures that their issues are heard, understood, and accommodated in a way that provides the highest value solution for all parties. ●

Value Engineering is a systematic and function-based process, carried out by a carefully selected team of specialists. The VE team follows a structured process, with the overall goal of helping team members communicate across boundaries, understand different perspectives, innovate, and analyze.

For more information, contact Norm Meyers, Planning and Design Section, Eastern Region, (613) 540-5158, or Norm.Meyers@mto.gov.on.ca

Upcoming Conference Information

November 16
2006 ITE/OTC Schoolzone Safety Workshop
Markham, Ontario

December 4 - 7
2006 Highway Geophysics - NDE Conference
St. Louis, Missouri

December 7
56th Annual Concrete Convention
St. Paul, Minnesota

January 21 - 25
TRB 86th Annual Meeting
Washington, D.C.

January 23-26
World of Concrete Convention
Las Vegas, Nevada

Climate Change

Will Our Bridges Be Over Troubled Waters?

Climate change has gained much interest in the past few years both within the scientific community and the general public. Its effects have been related to a number of factors including an increase of greenhouse gases, such as carbon dioxide. Recent studies indicate that climate change is a principal cause of increases in extreme storm events and high intensities of precipitation. It has now piqued the interest of public and private infrastructure managers.

How will climate change impact the transportation sector? It may require adaptive design measures to handle changes in climate. Can we continue to design drainage systems based on historical climate data and the assumption of a fixed climate? What actions can we take now to protect the highway infrastructure in the long run, in preparation for the potential impacts of climate change?

To answer these questions, the Ministry of Transportation sponsored a research project at McMaster University through the Highway Infrastructure Innovation Funding Program (HIIFP). The purpose of the study (directed by Dr. Paulin Coulibaly) was to investigate the potential impact of climate change on highway drainage infrastructure including bridges, culverts, storm sewers and stormwater management facilities. Dr. Coulibaly's research used models that predict the earth's climate to identify trends in precipitation and water flow on different catchment areas. These trends would better predict runoff flow rates that would need to be accommodated by the highway drainage infrastructure.

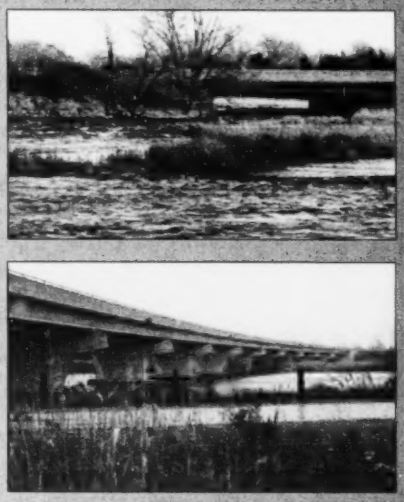
Current prediction models of the earth's climate are able to reasonably forecast changes in temperature over time. There are a number of different climate prediction models, generally referred to as Global Climate Models (GCMs). These models provide temperature and precipitation predictions using a 350 km by 350 km grid system. However, this scale is considered to be very large, especially when trying to predict temperatures and precipitation at a specific location. Furthermore, GCMs have been unable to accurately predict precipitation, compared to actual values measured at monitoring locations. This lack of accuracy is due to the added complexity of predicting the behaviour of a number of systems including storm patterns, wind speed, and air moisture content.

To overcome the limitations of the GCMs, Dr. Coulibaly used techniques to relate the GCM temperature and precipitation predictions to local precipitation data. By identifying the relationship of the GCM simulations and local weather conditions based on historic data, future predictions of the GCM can be translated into local precipitation predictions. To determine estimates of local and regional values of future daily precipitation and variability, eight rainfall stations were selected to represent typical southern and northern Ontario regions. Four stations were in the Grand River watershed and the other four rainfall stations were located in the Kenora/Rainy River watershed.

To show how much, how long and how often precipitation occurs in the two test regions, rainfall intensity-duration-frequency (IDF) curves were derived using the GCMs and daily precipitation data from the rainfall stations. To detect rainfall trends, IDF curves were developed for four time periods, the present, 2020, 2050 and 2100.

The IDF curves showed changes in precipitation intensity, suggesting that by 2050 and 2100 a 24% and 35% increase in heavy, and more frequent, rainfall events can be expected. All correlations showed these increasing trends, except for the 2020s when there was a decrease. In his study, Dr. Coulibaly indicated that this decrease is consistent with the decrease observed in the raw GCM simulations and can therefore be related to the GCM predictions rather than the statistical techniques used to determine the local conditions.

Dr. Coulibaly suggests that highway drainage infrastructure may be significantly affected by climate change. He predicted that, by 2050, highway drainage systems designed to accommodate storms that occur once in 10 years may only be able to accommodate storms that occur once in 5-years. Larger highway drainage systems designed for a once in 50-year storm period might only be able to accommodate a once in 20-year storm period. Dr. Coulibaly suggests that design flow rates (the estimated runoff flow rates) may need to be increased leading to larger bridges, culverts, storm sewers and stormwater management ponds to maintain the level of service provided today and to avoid potential constricted water flow and possible future flooding events.



Larger type bridges that would have a significant cost associated with any future changes:
TOP: Moira River Bridge, Highway 401
BOTTOM: Welland Canal Bridge, Highway 406

While this research provides some insight into the potential impact of climate change on highway drainage infrastructure based on a limited number of sites and a short period of rainfall record, more research is required to fully understand future climate effects on rainfall and flow rates before considering modifications to highway drainage design standards. ●

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A Growing OGRA Member Service Supported by MTO

Municipal DataWorks

Municipalities are accountable for managing billions of dollars worth of assets, which requires accurate and reliable information on the assets' inventory and current conditions for future planning. With this in mind, the Ontario Good Roads Association (OGRA) developed the Municipal DataWorks (MDW) program to address the asset management needs of municipal governments in Ontario. Asset management is a corporate philosophy that utilizes a system of formal processes based on engineering principles, sound business practices and economic rationale to effectively maintain, upgrade and operate public infrastructure assets over their lifecycles. To manage and maintain public infrastructure, municipalities must possess relevant strategic and operational information and analysis - which can be obtained through asset management practices. The Ministry of Transportation (MTO) has provided start-up funding for the development of MDW; a smart investment based on achievements to date with this new OGRA member service.

MDW Highlights

- As a member service, OGRA provides MDW at no cost to municipalities.
- A data warehouse compatible with the Municipal Infrastructure Data Standard (MIDS 3) where municipalities can build and maintain their inventory of public works assets
- MDW features Road and Bridge Inspection Tools (including calculation of BCI and BSI), Capital Investment Plan (CIP), and Water and Sewer modules.
- Report generating capabilities for presentation and analysis.
- Geographic Information Systems (GIS) tools for mapping and analysis
- Supports existing asset management tools
- Secure web access
- 78 municipalities in Ontario are now using MDW for asset management
- Website: www.ogra.org/mdw

A good asset management system depends on data that is current, easily accessible, easy to manage, and ideally based on a uniform standard which is consistent across the province. Municipal DataWorks is a web-based data storage repository for infrastructure asset data, based on Municipal Infrastructure Data Standard (MIDS 3.0 - the new common data standard for Ontario). MDW features the core asset inventory and the condition repository for roads, bridges, water, and sewers. In addition, the program also includes road and bridge inspection tools, a Capital Investment Plan tool (CIP), and a Road Data Conversion tool (RDC). Currently, an Asset Valuation module is being developed to assist municipalities in calculating "asset values" and generating reports that will comply with upcoming Public Sector Accounting Board (PSAB) requirements. MDW is an OGRA member service that allows municipalities, service providers, OGRA, and the provincial government to collect, access, evaluate, and report on infrastructure assets.

The Ministry of Transportation looks to Municipal DataWorks for the collection of municipal road system data and for tools that municipalities can use to provide the Road Sufficiency Index (RSI) by using the Pavement Condition Index (PCI), the Bridge Condition Index (BCI), and the Bridge Sufficiency Index (BSI) calculations for the Canada-Ontario Municipal Rural Infrastructure Fund (COMRIF) and legacy funding programs. The road and bridge inventory and inspection module launched in 2005 provides inspection forms and calculators for PCI, BCI and BSI.

The Capital Investment Plan (CIP) tool launched in June 2006 allows municipalities to analyze their asset data and create a long-term investment plan that answers crucial questions like: What work needs to be done? Which work should be done first? How much it will cost? How it will affect the condition of the operating network? What will be the impact on the operating costs? Obtaining this information results in assets being treated with appropriate interventions to extend their useful life, which will save the municipality money in the long run.

The latest module released in July 2006 stores water and sewer asset data, plus tracks the condition of water, storm, and sanitary sewer networks. Municipalities can use MDW to record, store, and analyze asset and condition information about pipes, catch basins, hydrants, and valves. The water and sewer module also supports Bill 175 by enabling municipalities to better assess the condition of their municipal water and sewer networks, a matter that is becoming increasingly important to the Province of Ontario. Bill 175 requires municipalities to report to the Ministry of Environment on the provision of water and wastewater services, including information on the full cost of providing services (i.e., operating, financing, renewal, replacement, and improvement costs).

After recognizing the benefits of Municipal DataWorks, the Ontario Road Builders Association (ORBA) recently contributed funding towards development. In addition to partnerships with MTO and ORBA, twenty-one service providers are using MDW on behalf of municipal clients, thus demonstrating the practical application of MDW.

To get started on using MDW, municipalities must sign the municipal Data Provision Agreement (DPA), or have their service provider sign the Licence Agreement to use MDW on their behalf. Both agreements are available on the OGRA/MDW website: www.ogra.org/mdw

To take MDW for a test run in Demo Town, visit the OGRA/MDW website, click on "Test Drive," fill out the request for contact information, and send. You will receive a user ID and password in a separate email.

The Ontario Good Roads Association looks forward to the continued progress of MDW as an indispensable member service. MDW not only provides asset management tools for OGRA members, but is also a key part of OGRA's advocacy program for sustainable funding for municipal infrastructure in Ontario. •

For more information about Municipal DataWorks, contact Brian Anderson, OGRA's Coordinator of Infrastructure Services, at (519) 674-0259 or brian@ogra.org

Engineering the North Bay Bypass for Increased Safety and Reduced Delays

Identifying Values

Value engineering (VE) is an approach that MTO uses on selected transportation upgrade and expansion projects. VE combines creativity with a structured review process for highway facility planning and design. In Fall 2004, MTO applied VE principles to Highway 11/17 in North Bay to help scope the preferred plan for improving the movement of provincial traffic on the existing bypass.

The North Bay bypass was originally constructed in 1953 as a two-lane facility. Numerous upgrades have been undertaken since the initial construction including additional lanes, traffic signals, and others to accommodate increased local and provincial traffic and improve its efficiency and safety.

However, it was recognized that this bypass would not be able to accommodate these needs in the long term. Therefore, during the late 1970s, an alternate expressway route for provincial traffic, with proposed local service connections, was "designated" after public consultation, consideration of various alternatives and acceptance by MTO and the City of North Bay.

Development pressures in recent years and changes to MTO design standards reignited the need to ensure that the property required for the future expressway route is protected. Northeastern Region staff recommended a VE project to re-examine the issues with the existing bypass, clearly identify operational problems, and confirm the proposed solution of constructing a different route through North Bay. A VE team was assembled with staff and experts from the private sector, the City of North Bay, and MTO. The VE team began its analysis of the bypass and the protected expressway route by outlining several issues associated with the existing bypass. Some concerns included: safety, performance expectations, commercial growth, increasing travel demands, and ongoing development pressure such as upcoming subdivision lots and new businesses. The team generated 92 ideas to address the issues, plus 23 alternatives and 11 design suggestions.

The VE team used Function Analysis System Technique (FAST) to improve the team's understanding of the project, and assist in the generation of project requirements. FAST is organised in chart form so the team, while asking the questions "How?" and "Why?", can identify required project functions. For Highway 11/17 in North Bay, the basic project functions identified were "reduce delay in traffic," and "increase safety." These were used to articulate more specific goals such as improvements to city transit and identifying truck routes. Project performance measures including public safety, environmental and property impacts were listed in the evaluation of the proposed alternatives. These performance measures will also be considered during the planning, design and construction of the new route. The VE team divided into two groups to develop and evaluate ideas and scenarios for construction. The proposals focused on specific components, which were then grouped into three broad areas: improving the existing bypass, constructing a new bypass, and relocating Highway 11 North. Alternative designs were developed within each group. The team then scored them according to performance.

The five alternatives developed and compared based on a performance/cost ratio included:

- Upgrade the existing bypass
- Construct a rural freeway on the expressway alignment
- Construct an urban freeway on the expressway alignment
- Relocate the Trout Lake Road Interchange to align with the expressway urban freeway alignment
- Build an urban freeway on the expressway alignment with the relocated Highway 11 North.

The workshop also generated several ideas for improving the performance of the North Bay bypass. The fifth alternative (an urban freeway on the dedicated expressway alignment with a relocated Highway 11 North) provides the highest performance/cost ratio, and was recommended by the team. The VE team also identified a total of $15M in cost savings from a total project value of approximately $77M, along with a high performance value for this project. Components include: constructing Single Point Urban Interchanges at Algonquin Avenue and Trout Lake Road, including a 6.8m median with a tall wall barrier, and relocating Highway 11 North to connect to Highway 17 West near College Drive.

The VE team also recommended dividing the project into four phases for further planning, design and construction. The planning, preliminary design and Environmental Assessment of Phase 1 are now under way. ●

North Bay Highway 11/17 Bypass looking north at ONR crossing. Congestion has been a major issue associated with the crossing.

An example of a Single Point Urban Interchange (SPUI) in the Netherlands.

For more information, contact Mike Pearsall, Planning and Environmental Section, (705) 497-5452, or Mike.Pearsall@mto.gov.on.ca

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TWD Roadeo

More Than an 8 Second Ride

The 2nd annual safe driving TWD Truck Roadeo for the Bancroft AMC was held on June 14, 2006 at the Fraserville Patrol yard near Peterborough. Later that month, TWD's Kingston / Ottawa AMC held their 7th annual event at the Brockville Patrol yard. These roadeos tested the skills and expertise of their maintenance workers. With the support of MTO Eastern Region, TWD has used this event to utilize a broad range of equipment for safety training purposes.

The Roadeo consists of a driving course with 5 obstacles and a pre-trip vehicle inspection. This year's inspection was based on winter maintenance equipment. A plow and sander combo truck is given 5 specific defects by mechanics and the participant is judged on technique and their ability to find the defects stressing the importance of a pre-trip inspection.

The obstacles on the driving course tested their operating skill. The offset alley required operators to maneuver through barricades offset to one another, with just the length of the truck separating the barricades. The serpentine obstacle tested the participants' ability to avoid barriers on both sides of the truck while making an "S" turn. This is done in a forward and reverse motion. Diminishing clearance and stop obstacles test the operators skill as the course starts with 4 inches of clearance on both sides of the vehicle and then narrows to 1 inch by the end of the obstacle.

MTO Maintenance Superintendents, Maintenance, Coordinators and Regional Fleet Coordinators judged and scored the skill testing events.

At Brockville, Mike Woods of Barriefield Patrol finished first; John Watson of Brockville Patrol finished 2nd; and Jim Hales, also from, Barriefield Patrol finished 3rd. At the Fraserville Roadeo, Marvin Siydock of Whitney / Barry's Bay Patrol finished first; Rob Armstrong of Bow Lake Patrol finished 2nd; and John Gionet of Fraserville Patrol finished 3rd.

TWD stresses safety in all aspects of their maintenance work and the Roadeo is just part of their on-going training. TWD's safety motto "Don't walk by" along with the safe driving roadeo have helped their staff achieve a category 1 achievement award from the Transportation Health & Safety Association of Ontario.

TWD Roads Management Inc. plans to continue to expand their annual safety events, eventually to all of their contracts throughout the province. •

For more information, contact Terry Nuttall, Contracts Office, at (613) 544-2220, Ext. 5167, or at Terry.Nuttall@mto.gov.on.ca.

MTO's Moose Creek Bridge Wins Bridge Award

Moose Creek Bridge, along with nine other concrete bridges, was selected to receive the 2006 PCA Bridge Design Award of Excellence as part of the Portland Cement Association's Tenth Biennial Bridge Awards Competition. MTO was presented its award November 5, 2006 at the Awards Program for the American Concrete Institute Fall Annual Convention in Denver, Colorado.

A three-member jury of prominent bridge professionals judged entries on criteria of creativity, functionality, and economy. Moose Creek Bridge was chosen for its excellent showcase of prefabricated technology and its "simple details, careful planning, and basic engineering [in addressing] the camber and differential camber issues and [developing] a robust joint for the precast deck."

Moose Creek, a prefabricated bridge constructed in 2004, is the first bridge in Ontario where prefabrication was used in construction of the substructure as well as

the superstructure. Bridge components were constructed under controlled conditions in plants in Brampton and Belleville allowing for the benefit of increased durability and requiring less maintenance in the long run. •

For more information, visit www.cement.org/bridges/

Visit our Road Talk Spring 2005 Issue for more information regarding Moose Creek Bridge or contact Iqbal Husain, Bridge Office, at (905) 704-2376 or Iqbal.Husain@mto.gov.on.ca.

Reader Response

Got a great article idea for Road Talk?

Send us any ideas, comments, or suggestions concerning local innovations, workshops, or seminars that you would like to see included in future issues.

Road Talk is also available in French.

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